

(January) and Sarawak (September). There is only one record for Hong Kong waters, June 1961 (Chalmers 1986).

### Discussion

Although there are very few published records for countries bordering the South China Sea, this is probably due to the difficulties involved in observing and identifying Swinhoe's Storm Petrel. The local fishermen in Pattani Bay claimed to be familiar with this species, but this may be due to confusion, since the Barn Swallow *Hirundo rustica* has the same local name and is a common migrant in the area. Southward movement down the east coast of the Malay Peninsula would be consistent with a migration route from the NW Pacific to the Indian Ocean via the South China Sea and the Sunda Strait. Further observations of this species are therefore to be expected, particularly from boats in the South China Sea.

### Acknowledgements

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## Biometrics, iris and bill colouration, and moult of Somali forest birds

by *Brian Wood*

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Although the dimensions and weight attained by individual birds are probably the consequence of a host of conflicting selection pressures, to

some extent they reflect both their evolutionary history and their immediate ecology. Our understanding of the influence of environment on morphology is likely to improve as data become available from more and more populations which may inhabit environments that differ subtly from one another. Whilst we know that quite striking size and weight differences may occur between locations only a few hundred kilometres apart (Moreau 1944, Britton 1977, Hanmer 1978), the overall picture is far from complete for any one species. Regrettably, some populations may be eliminated before any data can be obtained, as their habitats are destroyed during the course of 'development'. Data from populations at the edge of a species' range are often most enlightening, since relative isolation and slightly atypical environmental conditions can produce striking morphological responses, perhaps eventually leading to speciation. If we are ever to come near to attaining a complete understanding of how species have reacted to their environment, it is vital that data are collected from as many populations as possible whilst the opportunity still exists.

### Study site, materials and methods

Riverine forest was once extensive throughout the valleys of the Shabeelle and Jubba rivers in Somalia (Pichi-Sermoli 1957). It has now been cleared almost entirely along the Shabeelle and only 2 sizeable blocks remain in the Jubba valley, totalling about 400 ha (Madgwick *et al.* 1988). The forest depends upon the river for its existence, both as a source of ground-water and for the creation of suitable regeneration niches by periodic flooding. Riverine forest rarely extends more than c. 300 m either side of the river and has a varied structure and species composition, but is mostly evergreen, with a canopy height of 20 m or more, often with a dense understorey (Madgwick *in press*).

As part of the Somalia Research Project, the bird community of the remaining blocks of riverine forest, situated near to Hangoodle (01°05'N, 42°36'E), was surveyed during August and early September 1986. Mist nets were used to capture c. 500 individual birds, which were measured, weighed (to the nearest 0.1 g for birds weighing less than 50 g, and to the nearest 1.0 g for heavier birds). Information was also collected on all birds in moult (recorded by the method indicated by Ginn & Melville 1983). All birds were ringed, either with plastic colour rings or metal rings supplied by the East African Natural History Society, and released. Many were subsequently recaptured, enabling estimates of population size and range to be made (Wood *in press*).

There are few previous records from Somalia of many of the species recorded in this survey of the Jubba forests. It is apparent that most have a very localised distribution within the country (Ash & Miskell 1983). Unless the recent very rapid clearance of riverine forest is halted, there is a real risk that this bird community could disappear from Somalia within the next few years. Its continued existence is also threatened by spraying with insecticide to eradicate tsetse fly and by the imminent construction of a dam upstream, near Baardhere.

TABLE 1

Biometrics of birds caught in riverine forest, southern Somalia

SPECIES	NUMBER	WING LENGTH			WEIGHT		
		Range	Mean	S.D.	Range	Mean	S.D.
<i>Accipiter badius</i>	2	201-214	207		207-218	212	
<i>Accipiter minullus</i>	2	153-155	154		104-111	107	
<i>Accipiter tachiro</i>	1		250			440	
<i>Turtur chalcospilos</i>	1		106			67	
<i>Turtur tympanistria</i>	7♂♂	111-119	114.7	3.2	65-79	74.3	5.2
<i>Turtur tympanistria</i>	8♀♀	108-117	111.6	3.0	54-72	61.9	5.2
<i>Turtur tympanistria</i>	1		107			56	
<i>Ciccaba woodfordi</i>	4	243-253	249		241-294	266	
<i>Glaucidium capense</i>	4	136-141	138		100-112	106	
<i>Apaloderma narina</i>	7	119-127	122.7	2.4	52-59	55.0	2.9
<i>Ispidina picta</i>	21	47-57	51.0	2.7	8.9-13.6	10.8	1.5
<i>Halcyon albiventris</i>	7	92-96	94.1	1.5	39.9-45.8	44.2	3.3
<i>Halcyon senegaloides</i>	4	100-103	102		61-72	66	
<i>Phoeniculus purpureus</i>	1		140			87	
<i>Indicator variegatus</i>	15	99-108	103.0	3.2	39.5-46.8	44.7	2.1
<i>Campethera abingoni</i>	1		103			58	
<i>Dicrurus ludwigii</i>	8	97-107	101.1	4.9	22.3-28.7	25.7	6.5
<i>Turdoides squamulatus</i>	5	101-105	103		65-76	69	
<i>Andropadus importunus</i>	10	80-89	83.1	3.6	22.4-31.6	27.0	2.6
<i>Chlorocichla flaviventris</i>	6	95-106	101.5	4.9	28.3-47.1	40.5	6.5
<i>Nicator chloris</i>	2	92-104	98		36.3-46.0	41.1	
<i>Phyllastrephus strepitans</i>	45	73-88	81.6	4.3	21.4-32.9	27.1	3.5
<i>Cercotrichas quadrivirgata</i>	20	72-83	78.0	2.9	20.3-26.3	24.1	1.7
<i>Cossypha heuglini</i>	2	85-93	89		30.7-33.6	32.1	
<i>Cossypha natalensis</i>	69	81-95	88.7	3.4	23.7-33.4	29.1	2.3
<i>Apalis melanocephala</i>	1		49			8.4	
<i>Camaroptera brachyura</i>	31	46-57	52.0	3.4	7.1-10.3	8.7	0.8
<i>Muscicapa caerulescens</i>	10	71-80	76.2	2.9	15.6-17.2	16.4	0.6
<i>Platysteira peltata</i>	2♂♂	63-64			12.8-13.2		
<i>Platysteira peltata</i>	6♀♀	60-66	61.7	2.3	11.2-12.8	11.9	0.6
<i>Erythrocercus holochlorus</i>	1		45			5.0	
<i>Tersiphone viridis</i>	6♂♂	81-89	83.8	2.9	12.8-14.0	13.1	0.4
<i>Tersiphone viridis</i>	8♀♀	72-78	75.1	2.3	9.9-13.3	11.3	1.0
<i>Trochocercus cyanomelas</i>	13♂♂	62-67	64.8	1.5	9.6-12.1	10.2	0.7
<i>Trochocercus cyanomelas</i>	9♀♀	63-67	64.9	1.3	9.3-11.2	10.1	0.7
<i>Trochocercus cyanomelas</i>	1		64			9.6	
<i>Dryoscopus cuba</i>	5	78-82	80		25.0-30.0	26.9	
<i>Laniarius ferrugineus</i>	1		89			38.8	
<i>Anthreptes collaris</i>	9♂♂	48-51	49.3	0.9	5.3-6.9	6.2	0.5
<i>Anthreptes collaris</i>	8♀♀	47-50	48.4	0.9	5.4-6.5	5.9	0.4
<i>Anthreptes collaris</i>	1		51			6.5	
<i>Nectarinia amethystina</i>	1♂		63			9.4	
<i>Nectarinia olivacea</i>	54♂♂	56-65	58.6	1.5	6.8-9.1	7.7	0.4
<i>Nectarinia olivacea</i>	49♀♀	51-54	52.6	0.9	6.2-8.7	7.1	0.5
<i>Nectarinia veronii</i>	1		56			8.7	
<i>Ploceus bicolor</i>	26	84-91	87.9	1.9	29.4-37.5	33.1	2.1

## Results

The weights and wing length (maximum chord, Svensson 1984) of all birds at the time of their original capture are summarised in Table 1. Recapture weights have not been included as all recaptures were within a few days of original capture and consequently weights may have been influenced by handling and ringing. As was to be expected, there was



Figure 1. The weights of male and female Olive Sunbirds *Nectarinia olivacea* at time of capture in southern Somalia. Both sexes show a tendency to increase progressively in weight throughout the day.

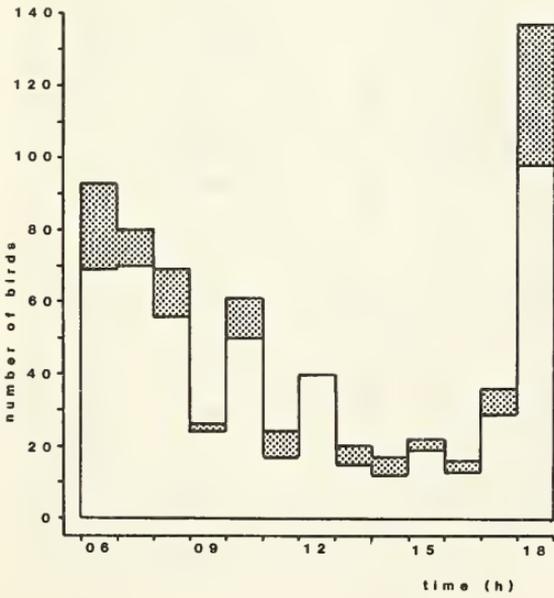


Figure 2. The number of birds caught (open histogram) and recaptured (shaded) in riverine forest in southern Somalia throughout the day.

evidence for diurnal weight increases, particularly for species caught often (Fig. 1), but no corrections to the recorded weights have been made to allow for this. Most species were caught throughout the day, or equally often in the evening as in the early morning (Fig. 2), so little bias will have been introduced by the lack of correction. Where weights differ from

those of other populations of the same species, this is discussed in the systematic list which follows. Comparisons have been made with published weights from Liberia (Colston & Curry-Lindahl 1986), Ghana (Greig-Smith & Davidson 1977), Nigeria (Jones 1984), Kenya (Britton 1970, 1972, 1977, Karr 1976a, Mann 1985), Tanzania (Moreau 1944), Zambia (Britton & Dowsett 1969, Peirce 1984), Mozambique (Hanmer 1978, 1980), Malawi (Hanmer 1978, 1980, Johnson 1985), Zimbabwe (Earle 1981) and South Africa (Biggs *et al.* 1979).

Several birds were also captured and ringed in degraded riverine forest at Balcad (02°20'N, 45°32'E) on the Shabeelle River on 19/20 September. Where relevant, details of these birds have also been included.

### Species accounts

#### SHIKRA *Accipiter badius*

Both birds captured were replacing their first secondary and were in the middle of tail moult. This begins with feathers 1 (centre) and 3, with 2 and 6 being the last to be replaced. No contour moult was occurring. Both were considerably heavier (207, 218 g) than a sample of 56 birds from South Africa (range 75–158 g).

#### LITTLE SPARROWHAWK *Accipiter minullus*

One of the 2 birds caught (7 Aug) was in full wing and tail moult, but was not moulting contour features; scores: primaries = 39, secondaries = 30, tail = 44.

#### EMERALD-SPOTTED WOOD DOVE *Turtur chalcospilus*

The single bird caught (5 Aug) was completing moult of wing and tail and was in mid contour moult.

#### TAMBOURINE DOVE *Turtur tympanistria*

Nine of the 16 birds were in moult. Timing of moult was very variable, with 3 birds in early wing moult (4 Aug–5 Sep) and 3 having completed primary moult but still in mid secondary moult. Tail moult was beginning in those in primary moult, but was completed or nearly so in others. Body moult was found at all stages. Male weights were significantly greater than those from Liberia, and both sexes were rather heavier than a small sample from East Africa (Britton 1970), but weighed almost the same as Tanzanian birds.

#### BARRED OWLET *Glaucidium capense*

One of 4 birds was beginning contour moult and replacing secondaries (score = 19 on 2 Sep). Somali birds had wing lengths (mean 138 mm) greater than those reported from Liberia (male 118, 2 females average 128 mm) but were considerably lighter (mean 106 g) than 5 birds from South Africa (average 129.4 g).

#### NARINAS TROGON *Apaloderma narina*

Six of 7 birds were completing moult (Fig. 3). Tail moult begins at 3 or 4 and ends at 1 and 6. Contour moult coincides with primary moult. Somali weights (mean 55 g) were considerably less than birds from Liberia (3 males, average 68.8 and one female 70.3 g) and one male from Zambia (72.0 g).

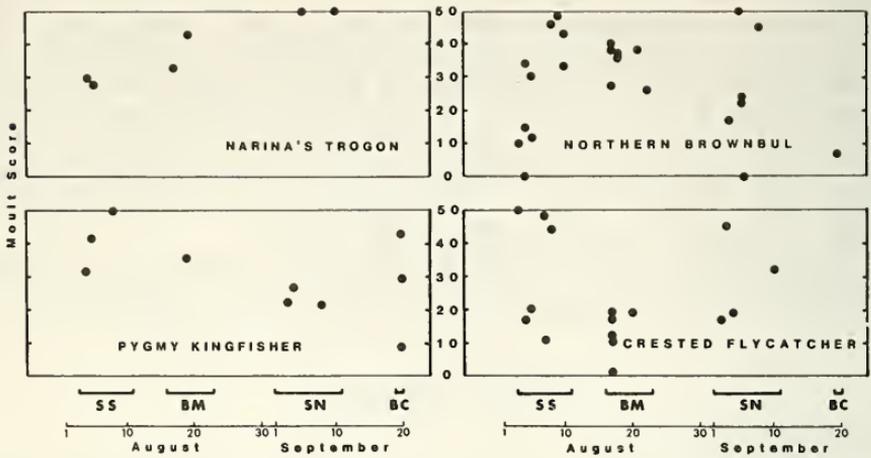


Figure 3. Primary moult scores of selected species caught in riverine forest. Horizontal bars indicate the periods of netting at Shoonto south (SS), Barako Madow (BM), Shoonto north (SN) and Balcad (BC).

#### PYGMY KINGFISHER *Ispidina picta*

Six of 21 birds were in active primary moult, as were 3 caught at Balcad on the Shabeelle on 19–20 Sep (Fig. 3). Rectrices were either old or up to mid-moult; contour moult was at all stages. This roughly coincides with the timing of the moult of immatures in Nigeria (Jones 1984) but is about 4 months later than in Malawi (Hanmer 1980), where moult appears to be protracted. Weights (mean 10.8 g) were significantly less than Nigerian birds (mean 12.4 g at 11°50'N), very much lighter than wet-season birds from Zambia (mean 14.3 g) and also much lighter than Malawi birds. They are close to weights from Ghana in the wet season (adult mean 11.4 g, juvenile mean 10.6 g, at 9°15'N) and of birds collected in Liberia (8 males mean 9.7, 6 females 11.1).

#### BROWN-HOODED KINGFISHER *Halcyon albiventris*

Three adults were in mid moult of primaries in early Aug and the fourth adult had suspended primary moult at score = 30. All 3 were beginning contour moult, and tail moult varied from about 1/3 to 2/3 completed. Three immatures caught in early Sep had all suspended primary moult (scores = 15 to 25). Mean wing length was less (94.1 mm) and weight lighter (44.2 g) than birds from Mozambique and Malawi (wing 96–108 mm, weight 48–68 g), where moult occurs 6 months out of phase with moult recorded in Somalia.

#### GREEN WOOD-HOOPOE *Phoeniculus purpureus*

The single bird caught was in mid tail moult and had begun primary moult.

#### SCALY-THROATED HONEYGUIDE *Indicator variegatus*

Three out of 15 were in active primary moult late Aug/early Sep. One had suspended primary moult at score = 15. Contour moult had begun in 2 birds.

**SQUARE-TAILED DRONGO** *Dicrurus ludwigii*

Five out of 8 were in active primary moult (scores = 17 to 41). These 5 and one other were in active tail, secondary and contour moult. Mean weight (25.7 g) was considerably lighter than 2 birds from Liberia, rather less than ones from Tanzania and very similar to weights in Ghana.

**SCALY BABBLER** *Turdoides squamulatus*

One out of 5 was in active regular primary moult (score = 28 on 5 Sep) and contour moult. Two more had irregular moult of primaries and secondaries.

**ZANZIBAR SOMBRE GREENBUL** *Andropadus importunus*

Six out of 10 were in primary moult in early Sep (scores = 22 to 44). One caught at Balcad on 20 Sep had suspended moult at score = 10. Weights were very similar to birds from the coast of Kenya (Britton 1972).

**NICATOR** *Nicator chloris*

One was undergoing a complete moult when caught on 17 Aug (primary score = 32).

**NORTHERN BROWNBUL** *Phyllastrephus strepitans*

Twenty-four out of 45 were moulting. Twenty-one were in active primary moult (Fig. 3). Ten had a regular moult of secondaries and tail, and most were replacing contour plumage. Tail moult was irregular in the other moulting birds. Britton (1972) sexed some Kenyan birds on wing length. Somali birds also appear to be separable on this character, with a wing length of 81 mm bisecting our sample exactly (one bird indeterminate). Iris colour varied, usually being recorded as pale stone or as brown/reddish-brown, but colour did not clearly correspond with size or sex (Fig. 4), although all the heaviest males and several of the largest females had brown or reddish-brown irises. Iris colour may be related to dominance status or could merely be a dimorphism that is not related to other characteristics.

**EASTERN BEARDED SCRUB ROBIN** *Cercotrichas quadrivirgata*

Of 20 birds caught, 3 had almost completed moult (primary scores = 45 to 55) on 16–19 Aug and a fourth bird had irregular moult of some primaries and secondaries. One of the 4 was completing contour moult.

**WHITE-BROWED ROBIN CHAT** *Cossypha heuglini*

The 2 birds caught had weights (30.7, 33.6 g) that were intermediate between those of birds from coastal and western Kenya but closer to the former. They were lighter than most Zambian birds.

**GREY-BACKED CAMAROPTERA** *Camaroptera brachyura*

Four out of 31 were completing tail moult, 2 were completing contour moult and 1 had almost completed primary moult (score = 47). All others caught appeared to have fresh wings but rather abraded tails. Weights (mean 8.7 g) were similar to 3 birds from southern Kenya (mean 8.9 g) but were lighter than birds from all other locations in Africa, including coastal Kenya (average of 65 birds, 9.29 g).

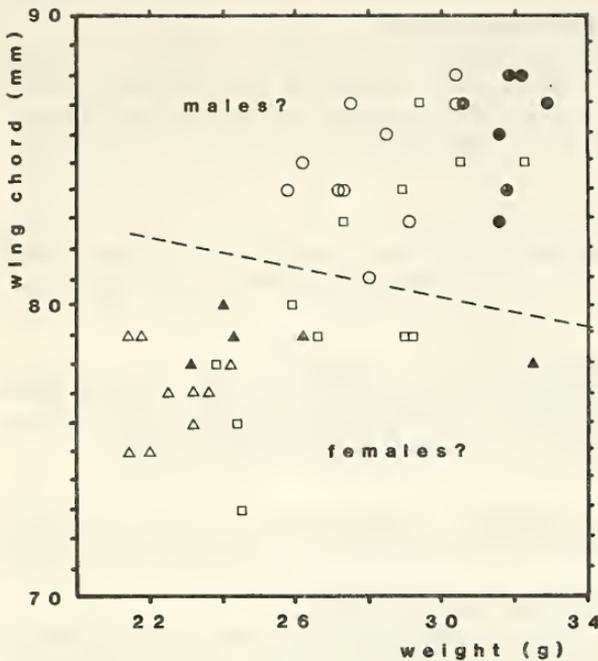


Figure 4. The relationship between wing length, weight and iris colour for probable male (circles) and female (triangles) Northern Brown-bulls *Phyllastrephus strepitans* in southern Somalia. Solid symbols are for birds with brown or reddish-brown irises, open symbols for birds with pale stone coloured irises. The iris colour of birds represented by open square symbols was not recorded.

#### BLACK-THROATED WATTLE-EYE *Platysteira peltata*

Seven out of 8 birds had some moult. Six were beginning contour moult, 1 was in active regular primary moult (score = 21 on 18 Aug) and 6 were replacing tail and secondary feathers.

#### LITTLE YELLOW FLYCATCHER *Erythrocerus holochlorus*

One bird caught and 3 seen in the field all had flesh-pink bills, not black as illustrated in Williams & Arlott (1980).

#### PARADISE FLYCATCHER *Terpsiphone viridis*

Out of 14 birds caught, 2 were beginning contour moult and primary moult (4 and 10 Sep) and 2 were replacing some secondaries. None was in tail moult. Weights ( $\delta$  mean 11.3,  $\text{♀}$  mean 10.2 g) were less than those from Liberia, western Kenya, Malawi and Zambia and also less than most birds from Ghana.

#### CRESTED FLYCATCHER *Trochocercus cyanomelas*

Sixteen out of 23 were in moult. Fifteen showed various stages of primary moult (Fig. 3), mostly with concurrent centrifugal tail moult. Fourteen were undergoing contour moult. Weights (mean  $\delta$  10.2, mean  $\text{♀}$  10.1 g) were similar to 3 birds from southern Kenya.

#### BLACK-BACKED PUFFBACK *Dryoscopus cubla*

One adult female was undergoing primary moult (score = 38 on 10 Sep) and one immature was beginning contour moult.

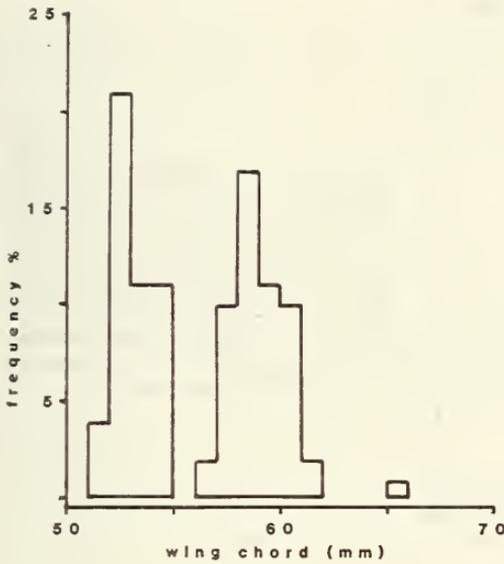


Figure 5. Wing length of Olive Sunbirds *Nectarinia olivacea* in southern Somalia.

#### COLLARED SUNBIRD *Anthreptes collaris*

Two out of 18 were beginning primary moult (scores = 2 and 16 on 4 and 10 Sep). Weights (mean ♂ 6.2, mean ♀ 5.9 g) were lighter than birds from Liberia, Zambia and western and coastal Kenya.

#### OLIVE SUNBIRD *Nectarinia olivacea*

Of 103 birds caught, 5 were beginning moult at the end of the survey period. Two had started primary moult (scores = 6, 11 on 7, 10 Sep) and 4 were beginning contour moult. Birds were not sexed at the time of capture, as both sexes have yellow pectoral tufts in Somalia. However, subsequent analysis of wing lengths enabled all birds to be sexed, males having wings 56 mm or longer and females 54 mm or less (Fig. 5). Both weights (mean ♂ 7.7, mean ♀ 7.1 g) and wing lengths (mean ♂ 58.6, mean ♀ 52.6 mm) are substantially greater in western Kenya (average weight 10.76 g, average wing length 62.96 mm of 42 unsexed birds). Weights are also less than in Liberia, coastal Kenya and substantially less than birds in Zimbabwe at all times of year.

#### MOUSE-COLOURED SUNBIRD *Nectarinia veroxii*

The single bird caught was in primary moult (score = 14 on 6 Sep) and was beginning contour moult.

#### DARK-BACKED WEAVER *Ploceus bicolor*

Early in the survey 8 birds out of 26 were in moult. Four were completing primary moult but 2 were midway through (scores = 23, 27 on 4, 5 Aug). Tail moult was ending in these latter 2 and 1 other, and all 3 were completing contour moult. Iris and bill colour varied considerably, and appears to be related to size (Fig. 6). Most heavy or long-winged birds had irises described as very dark brown, brown or dark hazel, whilst the remainder had brick red or dark brick irises. All had bluish-white bills

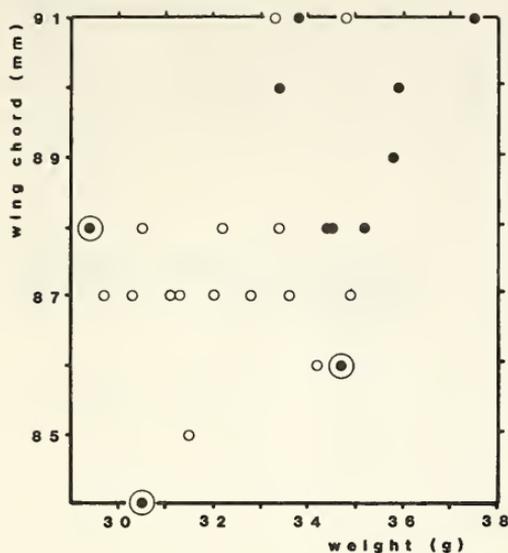


Figure 6. The relationship between wing length, weight, iris colour and bill colour of Dark-backed Weavers *Ploceus bicolor* in southern Somalia. Solid symbols indicate birds with very dark brown, brown or dark hazel irises, open symbols represent birds with brick red or dark red irises. Symbols encircled are birds with yellow-horn bills (probably immature).

except 3 light or short-winged birds with brown irises. These had yellow-horn or yellow-grey bills and may have been immatures.

### Discussion and conclusions

Insects, which form a major part of the diet of many of the bird species caught in the Jubba forest, are likely to be most abundant during the wet season and insectivores are most likely to breed at that time. In southern Somalia there are 2 wet seasons each year; the longest and most predictable 'gu' rains fall from April to June, and there is usually a less reliable 'dayr' wet season October/November. The most severe dry season lasts from December to March ('jilaal').

More than half all bird species evidently moult during the less severe dry season from July to September ('haggai'), but there are considerable differences in timing between species. In Uganda, where there are 2 substantial wet seasons each year, *Camaroptera brachyura* breeds twice each year and many birds can be found in moult in all months except April/May, when they breed. Moult is also often suspended during breeding September/October (Fogden & Fogden 1979). The few records of moulting birds in the Jubba suggest that here camaropteras moult early in the 'haggai' dry season, having probably bred during the 'gu' rains.

*Cercotrichas quadrivirgata* also moults early in the 'haggai', but most other species will still be moulting at the end of the 'haggai'. *Indicator variegatus*, *Turdoides squamulatus* and several flycatcher species have a particularly late moult. Surprisingly, none of the many *Cossypha natalensis* caught was in moult, although several juveniles were netted, which suggests that they breed during the 'gu' rains. Perhaps they moult very early, at the end of these rains, or not until the 'dayr' rains, when conditions for moult may be more favourable.

Where weights recorded in this study differ significantly from weights elsewhere in Africa, they are almost always lighter in the Jubba. As the study sites lie at just over 1°N and only a few metres above sea level, low weights were perhaps to be expected. Birds are likely to be bigger and weigh more where temperatures are lower, a pattern which has been described for several species in East Africa that occur at both coastal and much higher inland localities (Moreau 1944, Britton 1977, Hanmer 1978).

Other factors will select for small body size. Perrins (1970) suggested that small females will be able to begin breeding earlier following a seasonal increase in food supplies. In a situation where 2 short favourable seasons occur each year, during which breeding may be attempted, Downhower (1976) has found that only the smaller individuals are able to breed successfully if the favourable season is particularly short. Selection for small body size will be particularly strong for females, leading to a possible sexual size dimorphism.

Several species recorded from the Jubba are noticeably size dimorphic, with females being the smaller sex. This is quite commonly the case in African forest passerines (Dowsett 1983), but many more data are required before we can know if the degree of size dimorphism varies between populations. In southern Somalia the 2 wet seasons each year are both of short duration and may be very unreliable, thus selecting for small individuals that are able quickly to attain breeding condition. There are several cases where the weights of birds from the Jubba are lighter than birds almost everywhere else in Africa, except for some recorded in northern Ghana (Greig-Smith & Davidson 1977). The forest species which occur there are also likely to be dependent on narrow strips of gallery forest, along the watercourses. Small individuals could be favoured because conditions are as seasonally variable there as they are along the Jubba.

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## Note on the osteology and taxonomic position of Salvadori's Duck *Salvadorina waigiensis* (Aves: Anseridae [Anatidae]).

by Jiří Mlíkovský

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Salvadori's Duck *Salvadorina waigiensis* is an enigmatic bird of New Guinea mountain streams and lakes (Kear 1975), whose taxonomic